

Table S2-1. Training and testing AUC of A00-B99 (Certain infectious and parasitic diseases) in real-world situation.

	Training set		Testing set	
	AUC	F-measure	AUC	F-measure
Traditional pipeline				
NLP + SVM (linear)	0.9952	0.9768	0.9716	0.9289
NLP + SVM (polynomial)	0.9350	0.6582	0.9263	0.6578
NLP + SVM (radial basis)	0.9581	0.7783	0.9603	0.7861
NLP + SVM (sigmoid)	0.9581	0.7783	0.9603	0.7859
NLP + RF	1.0000	0.9938	0.9784	0.9440
NLP + GBM	0.9998	0.9921	0.9789	0.9435
Proposed pipeline				
GloVe + CNN	0.9974	0.9840	0.9858	0.9568

Table S2-2. Training and testing AUC of C00-D49 (Neoplasms) in real-world situation.

	Training set		Testing set	
	AUC	F-measure	AUC	F-measure
Traditional pipeline				
NLP + SVM (linear)	0.9959	0.9679	0.9834	0.9240
NLP + SVM (polynomial)	0.7684	0.6116	0.7510	0.6270
NLP + SVM (radial basis)	0.9533	0.8492	0.9436	0.8388
NLP + SVM (sigmoid)	0.9419	0.8370	0.9309	0.8334
NLP + RF	0.9995	0.9830	0.9846	0.9285
NLP + GBM	0.9990	0.9775	0.9852	0.9246
Proposed pipeline				
GloVe + CNN	0.9956	0.9666	0.9915	0.9541

Table S2-3. Training and testing AUC of D50-D89 (Diseases of the blood and blood-forming organs and certain disorders involving the immune mechanism) in real-world situation.

	Training set		Testing set	
	AUC	F-measure	AUC	F-measure
Traditional pipeline				
NLP + SVM (linear)	0.9974	0.9828	0.9695	0.9266
NLP + SVM (polynomial)	0.9518	0.6698	0.9273	0.6144
NLP + SVM (radial basis)	0.9827	0.8697	0.9708	0.8525
NLP + SVM (sigmoid)	0.9825	0.8694	0.9706	0.8523
NLP + RF	0.9999	0.9919	0.9782	0.9535
NLP + GBM	0.9996	0.9887	0.9750	0.9512
Proposed pipeline				
GloVe + CNN	0.9982	0.9910	0.9829	0.9631

Table S2-4. Training and testing AUC of E00-E89 (Endocrine, nutritional and metabolic diseases) in real-world situation.

	Training set		Testing set	
	AUC	F-measure	AUC	F-measure
Traditional pipeline				
NLP + SVM (linear)	0.9970	0.9866	0.9876	0.9657
NLP + SVM (polynomial)	0.9096	0.7079	0.8970	0.6930
NLP + SVM (radial basis)	0.9498	0.7878	0.9501	0.7876
NLP + SVM (sigmoid)	0.9414	0.7511	0.9414	0.7493
NLP + RF	1.0000	0.9969	0.9893	0.9756
NLP + GBM	0.9998	0.9938	0.9891	0.9748
Proposed pipeline				
GloVe + CNN	0.9970	0.9803	0.9906	0.9710

Table S2-5. Training and testing AUC of F01-F99 (Mental, Behavioral and Neurodevelopmental disorders) in real-world situation.

	Training set		Testing set	
	AUC	F-measure	AUC	F-measure
Traditional pipeline				
NLP + SVM (linear)	0.9998	0.9955	0.9875	0.9671
NLP + SVM (polynomial)	0.9747	0.8755	0.9481	0.8206
NLP + SVM (radial basis)	0.9811	0.8952	0.9791	0.8909
NLP + SVM (sigmoid)	0.9616	0.8465	0.9625	0.8355
NLP + RF	1.0000	0.9972	0.9860	0.9697
NLP + GBM	1.0000	0.9968	0.9852	0.9707
Proposed pipeline				
GloVe + CNN	0.9998	0.9976	0.9937	0.9811

Table S2-6. Training and testing AUC of G00-G99 (Diseases of the nervous system) in real-world situation.

	Training set		Testing set	
	AUC	F-measure	AUC	F-measure
Traditional pipeline				
NLP + SVM (linear)	0.9967	0.9697	0.9573	0.8629
NLP + SVM (polynomial)	0.9175	0.4967	0.8590	0.3819
NLP + SVM (radial basis)	0.9730	0.7843	0.9524	0.7253
NLP + SVM (sigmoid)	0.9724	0.7844	0.9519	0.7247
NLP + RF	1.0000	0.9961	0.9660	0.8929
NLP + GBM	0.9997	0.9867	0.9626	0.8839

Proposed pipeline

GloVe + CNN	0.9983	0.9889	0.9771	0.9297
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Table S2-7. Training and testing AUC of H00-H59 (Diseases of the eye and adnexa) in real-world situation.

	Training set		Testing set	
	AUC	F-measure	AUC	F-measure
Traditional pipeline				
NLP + SVM (linear)	0.9992	0.9904	0.9784	0.9295
NLP + SVM (polynomial)	0.9882	0.8660	0.9486	0.7917
NLP + SVM (radial basis)	0.9527	0.8846	0.9556	0.8805
NLP + SVM (sigmoid)	0.9523	0.8839	0.9555	0.8801
NLP + RF	1.0000	0.9982	0.9876	0.9483
NLP + GBM	1.0000	0.9953	0.9834	0.9472
Proposed pipeline				
GloVe + CNN	0.9998	0.9982	0.9868	0.9547

Table S2-8. Training and testing AUC of H60-H95 (Diseases of the ear and mastoid process) in real-world situation.

	Training set		Testing set	
	AUC	F-measure	AUC	F-measure
Traditional pipeline				
NLP + SVM (linear)	0.9998	0.9922	0.9854	0.9008
NLP + SVM (polynomial)	0.9707	0.6185	0.9100	0.4547
NLP + SVM (radial basis)	0.9827	0.8880	0.9807	0.8420
NLP + SVM (sigmoid)	0.9833	0.8867	0.9811	0.8411
NLP + RF	1.0000	0.9935	0.9781	0.9580
NLP + GBM	1.0000	0.9909	0.9799	0.9320
Proposed pipeline				
GloVe + CNN	0.9999	0.9994	0.9870	0.9574

Table S2-9. Training and testing AUC of I00-I99 (Diseases of the circulatory system) in real-world situation.

	Training set		Testing set	
	AUC	F-measure	AUC	F-measure
Traditional pipeline				
NLP + SVM (linear)	0.9956	0.9833	0.9830	0.9565
NLP + SVM (polynomial)	0.9111	0.7378	0.9054	0.7377
NLP + SVM (radial basis)	0.9590	0.8772	0.9637	0.8845
NLP + SVM (sigmoid)	0.9513	0.8552	0.9559	0.8580
NLP + RF	0.9996	0.9946	0.9854	0.9660

NLP + GBM	0.9997	0.9919	0.9850	0.9660
Proposed pipeline				
GloVe + CNN	0.9957	0.9760	0.9878	0.9639

Table S2-10. Training and testing AUC of J00-J99 (Diseases of the respiratory system) in real-world situation.

	Training set		Testing set	
	AUC	F-measure	AUC	F-measure
Traditional pipeline				
NLP + SVM (linear)	0.9977	0.9849	0.9800	0.9365
NLP + SVM (polynomial)	0.9150	0.5799	0.8963	0.5808
NLP + SVM (radial basis)	0.9676	0.8120	0.9632	0.8087
NLP + SVM (sigmoid)	0.9675	0.8118	0.9631	0.8084
NLP + RF	1.0000	0.9973	0.9870	0.9586
NLP + GBM	0.9999	0.9935	0.9846	0.9588
Proposed pipeline				
GloVe + CNN	0.9988	0.9891	0.9869	0.9568

Table S2-11. Training and testing AUC of K00-K95 (Diseases of the digestive system) in real-world situation.

	Training set		Testing set	
	AUC	F-measure	AUC	F-measure
Traditional pipeline				
NLP + SVM (linear)	0.9938	0.9723	0.9684	0.9182
NLP + SVM (polynomial)	0.9087	0.6485	0.8693	0.6147
NLP + SVM (radial basis)	0.9497	0.8094	0.9329	0.7742
NLP + SVM (sigmoid)	0.9496	0.8094	0.9328	0.7741
NLP + RF	0.9999	0.9946	0.9790	0.9375
NLP + GBM	0.9998	0.9942	0.9808	0.9373
Proposed pipeline				
GloVe + CNN	0.9960	0.9711	0.9827	0.9389

Table S2-12. Training and testing AUC of L00-L99 (Diseases of the skin and subcutaneous tissue) in real-world situation.

	Training set		Testing set	
	AUC	F-measure	AUC	F-measure
Traditional pipeline				
NLP + SVM (linear)	0.9958	0.9599	0.9538	0.8049
NLP + SVM (polynomial)	0.9456	0.5716	0.8621	0.4318
NLP + SVM (radial basis)	0.9683	0.7583	0.9504	0.7391
NLP + SVM (sigmoid)	0.9677	0.7582	0.9498	0.7377

NLP + RF	1.0000	0.9913	0.9444	0.8604
NLP + GBM	0.9996	0.9825	0.9470	0.8509
Proposed pipeline				
GloVe + CNN	0.9985	0.9914	0.9682	0.9263

Table S2-13. Training and testing AUC of M00-M99 (Diseases of the musculoskeletal system and connective tissue) in real-world situation.

	Training set		Testing set	
	AUC	F-measure	AUC	F-measure
Traditional pipeline				
NLP + SVM (linear)	0.9932	0.9620	0.9653	0.9094
NLP + SVM (polynomial)	0.9494	0.7045	0.9010	0.5915
NLP + SVM (radial basis)	0.9548	0.7988	0.9383	0.7734
NLP + SVM (sigmoid)	0.9547	0.7989	0.9381	0.7734
NLP + RF	0.9990	0.9891	0.9711	0.9257
NLP + GBM	0.9997	0.9884	0.9742	0.9197
Proposed pipeline				
GloVe + CNN	0.9948	0.9713	0.9769	0.9345

Table S2-14. Training and testing AUC of N00-N99 (Diseases of the genitourinary system) in real-world situation.

	Training set		Testing set	
	AUC	F-measure	AUC	F-measure
Traditional pipeline				
NLP + SVM (linear)	0.9935	0.9713	0.9660	0.9016
NLP + SVM (polynomial)	0.9288	0.6838	0.9217	0.7008
NLP + SVM (radial basis)	0.9594	0.7998	0.9635	0.8415
NLP + SVM (sigmoid)	0.9593	0.7997	0.9634	0.8415
NLP + RF	0.9999	0.9953	0.9733	0.9246
NLP + GBM	0.9997	0.9918	0.9726	0.9219
Proposed pipeline				
GloVe + CNN	0.9962	0.9756	0.9842	0.9492

Table S2-15. Training and testing AUC of O00-O9A (Pregnancy, childbirth and the puerperium) in real-world situation.

	Training set		Testing set	
	AUC	F-measure	AUC	F-measure
Traditional pipeline				
NLP + SVM (linear)	0.9999	0.9980	0.9971	0.9890
NLP + SVM (polynomial)	0.9988	0.9600	0.9929	0.9046
NLP + SVM (radial basis)	0.9978	0.9720	0.9945	0.9692

NLP + SVM (sigmoid)	0.9978	0.9720	0.9944	0.9689
NLP + RF	1.0000	0.9982	0.9960	0.9875
NLP + GBM	0.9999	0.9980	0.9988	0.9887
Proposed pipeline				
GloVe + CNN	0.9999	0.9996	0.9980	0.9919

Table S2-16. Training and testing AUC of P00-P96 (Certain conditions originating in the perinatal period) in real-world situation.

	Training set		Testing set	
	AUC	F-measure	AUC	F-measure
Traditional pipeline				
NLP + SVM (linear)	0.9992	0.9810	0.9930	0.9471
NLP + SVM (polynomial)	0.9931	0.8208	0.9930	0.7821
NLP + SVM (radial basis)	0.9936	0.8907	0.9952	0.9118
NLP + SVM (sigmoid)	0.9935	0.8907	0.9952	0.9118
NLP + RF	0.9998	0.9812	0.9879	0.9418
NLP + GBM	0.9996	0.9778	0.9800	0.9471
Proposed pipeline				
GloVe + CNN	0.9998	0.9989	0.9978	0.9758

Table S2-17. Training and testing AUC of Q00-Q99 (Congenital malformations, deformations and chromosomal abnormalities) in real-world situation.

	Training set		Testing set	
	AUC	F-measure	AUC	F-measure
Traditional pipeline				
NLP + SVM (linear)	0.9934	0.9230	0.9143	0.7376
NLP + SVM (polynomial)	0.8983	0.3187	0.7808	0.1655
NLP + SVM (radial basis)	0.9729	0.7643	0.9052	0.6208
NLP + SVM (sigmoid)	0.9713	0.7539	0.9076	0.6202
NLP + RF	0.9999	0.9707	0.9120	0.7509
NLP + GBM	0.9988	0.9353	0.8956	0.6882
Proposed pipeline				
GloVe + CNN	0.9993	0.9955	0.9055	0.7819

Table S2-18. Training and testing AUC of R00-R99 (Symptoms, signs and abnormal clinical and laboratory findings, not elsewhere classified) in real-world situation.

	Training set		Testing set	
	AUC	F-measure	AUC	F-measure
Traditional pipeline				
NLP + SVM (linear)	0.9809	0.8829	0.8898	0.7365
NLP + SVM (polynomial)	0.8693	0.4650	0.8193	0.4042

NLP + SVM (radial basis)	0.9442	0.6978	0.9099	0.6404
NLP + SVM (sigmoid)	0.9433	0.6962	0.9090	0.6390
NLP + RF	0.9967	0.9759	0.9091	0.7372
NLP + GBM	0.9993	0.9805	0.9172	0.7600
Proposed pipeline				
GloVe + CNN	0.9872	0.9573	0.9399	0.8726

Table S2-19. Training and testing AUC of S00-T88 (Injury, poisoning and certain other consequences of external causes) in real-world situation.

	Training set		Testing set	
	AUC	F-measure	AUC	F-measure
Traditional pipeline				
NLP + SVM (linear)	0.9840	0.9206	0.8861	0.7366
NLP + SVM (polynomial)	0.9301	0.6424	0.8463	0.5729
NLP + SVM (radial basis)	0.9094	0.6930	0.8617	0.6816
NLP + SVM (sigmoid)	0.9092	0.6930	0.8614	0.6815
NLP + RF	0.9993	0.9787	0.8481	0.7448
NLP + GBM	0.9995	0.9784	0.8840	0.7481
Proposed pipeline				
GloVe + CNN	0.9941	0.9689	0.9271	0.8386

Table S2-20. Training and testing AUC of V00-Y99 (External causes of morbidity) in real-world situation.

	Training set		Testing set	
	AUC	F-measure	AUC	F-measure
Traditional pipeline				
NLP + SVM (linear)	0.9699	0.3938	0.7448	0.0722
NLP + SVM (polynomial)	0.6930	0.0723	0.6054	0.0178
NLP + SVM (radial basis)	0.9379	0.4137	0.7386	0.0468
NLP + SVM (sigmoid)	0.8735	0.3088	0.5977	0.0248
NLP + RF	0.9997	0.9313	0.6939	0.0246
NLP + GBM	0.9995	0.9269	0.6577	0.0721
Proposed pipeline				
GloVe + CNN	0.9986	0.9878	0.8086	0.3257

Table S2-21. Training and testing AUC of Z00-Z99 (Factors influencing health status and contact with health services) in real-world situation.

	Training set		Testing set	
	AUC	F-measure	AUC	F-measure
Traditional pipeline				
NLP + SVM (linear)	0.9562	0.8711	0.8398	0.7094

NLP + SVM (polynomial)	0.7582	0.5546	0.7435	0.5535
NLP + SVM (radial basis)	0.8631	0.6789	0.8223	0.6394
NLP + SVM (sigmoid)	0.8630	0.6787	0.8222	0.6392
NLP + RF	0.9981	0.9754	0.8790	0.6932
NLP + GBM	0.9961	0.9634	0.8536	0.7056
Proposed pipeline				
GloVe + CNN	0.9623	0.8976	0.8947	0.7833